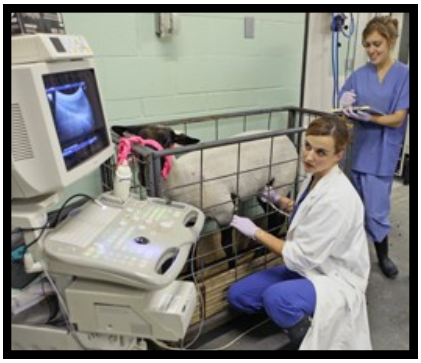
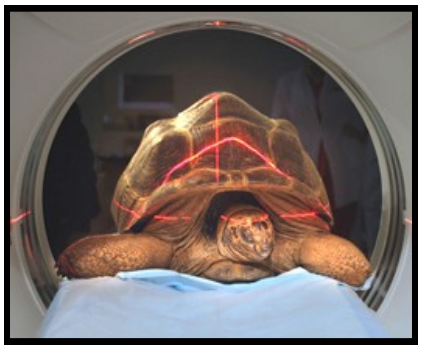
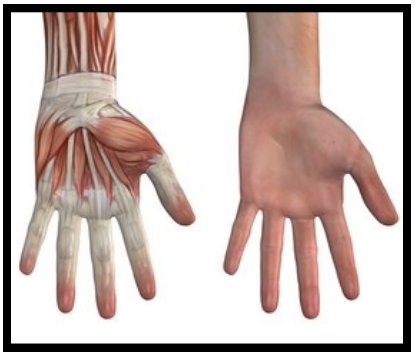
Advanced Biotechnologies in Texas

The State's Cutting-Edge Life Science Sectors | 2013







TEXAS
WIDE OPEN FOR BUSINESS™

Office of the Governor | Economic Development & Tourism

Contents

Biodefense &
Pandemic Preparedness

UTMB Galveston's National Biocontainment Training Center

In the years since September 11, 2001, efforts have intensified to develop medical countermeasures against the threat of biological warfare and terrorism. These technologies are designed to inoculate citizens against infectious agents that may be used in an attack; to detect biological, chemical or nuclear attacks; and to diagnose and treat those who may have been exposed to such attacks. In addition, technologies can make urgently needed treatments easier to administer on the battlefield or during a civilian crisis.

TEXAS RESEARCH CENTERS

Texas A&M Center for Innovation in Advanced Development and Manufacturing (CIADM)—Bryan-College Station

In June 2012, the U.S. Dept. of Health & Human Services designated Texas A&M University, in partnership with GlaxoSmithKline Vaccines, Kalon Biotherapeutics, and Lonza Group, to lead one of three national biodefense centers. Created as public-private partnerships, the centers will protect Americans from bioterrorism, natural pandemics, and other health threats. http://ciadm.tamus.edu

University of Texas Medical Branch (UTMB) at Galveston, Center for Biodefense and Emerging Infectious Diseases (CBEID)—Galveston

Established in 2002 by the National Institutes of Health (NIH), UTMB CBEID's primary mission is to reduce the nation's vulnerability to biological weapons for warfare and terrorism and to develop treatments for emerging and tropical infectious diseases. The center has attracted a multidisciplinary team of research scientists with broad expertise in biodefense and emerging infectious disease agents.

Research programs have been developed in the basic biology of bacterial and viral biological warfare and terrorist pathogens. Since 2003, the CBEID has served as one of the nation's 11 federal Regional Centers of Excellence (RCE) for Biodefense and Emerging Infectious Diseases Research. As the Western RCE, the CBEID is the lead institution for over 40 participating academic institutions in the Western Region, a five-state area that includes Louisiana, Arkansas, New Mexico, and Oklahoma. UTMB at Galveston is also home to the Robert E.

One of the nation's three new **national biodefense centers** is located in Texas. The Texas center opened in July 2012.

Shope Laboratory, a Biosafety Level 4 facility opened in 2004. The 12,000-sq. ft. lab is the first full sized facility of its kind in the nation to be located on a university campus. www.utmb.edu/cbeid

Galveston National Laboratory (GNL) at UTMB

The GNL is one of the nation's two National Biocontainment Laboratories. It was established with grants

awarded in 2003 by NIH's National Institute of Allergy and Infectious Diseases (NIAID). The GNL conducts research to develop therapies, vaccines, and diagnostic tests for diseases such as SARS, West Nile encephalitis, and avian flu, as well as for microbes that might be employed by terrorists. www.utmb.edu/gnl

Texas Tech University, Center for Biodefense, Law & Public Policy—Lubbock

Established in 2002, the center supports three groundbreaking educational programs, including the JD/MD with Biodefense Concentration, JD/MS Environmental Toxicology with Biodefense Focus, and the Law and Biodefense Certificate. Faculty are drawn from throughout the Texas Tech System from multiple disciplines such as law, microbiology, medicine, forensic science, pathology, animal science, and plant science. www.ttu.edu/biodefense


Pulmotect

Texas Biomedical Research Institute (Texas Biomed)—San Antonio

Located on 200 acres in San Antonio, TX, Texas Biomed is one of the world's leading independent biomedical research institutions and is the only institution in the country housing both a National Primate Research Center and a Biocontainment Level 4 lab. The institute's Infectious Disease and Biodefense group possesses expertise in high-level biocontainment facilities and practices. Two components of the Western RCE in Biodefense and Emerging Infections are directed by members of this Texas Biomed group. www.txbiomed.org

EXAMPLE TEXAS COMPANIES

G-CON (Bryan)

The company manufactures self-contained clean-room units, called PODS, that can be used for multiple applications, including vaccine and drug development and biomanufacturing. www.gconbio.com

1st Detect (Austin)

1st Detect's breakthrough Miniature Chemical Detector provides rapid chemical analysis and is capable of detecting residues and vapors from a wide range of chemicals, including explosives and chemical warfare agents. www.1stdetect.com

Pulmotect (Houston)

Pulmotect develops products that boost the innate immune system to raise the body's natural defenses against a wide range of lung infections, from influenza to bioterror agents such as anthrax and plague. www.pulmotect.com

RECENT DEVELOPMENTS

In March 2013, **Texas A&M University** and **GlaxoSmithKline** announced they will partner to create a $91 million world-class vaccination and biodefense facility in College Station, Texas. The new facility will employ 200 to 300 and anchor the **Texas A&M Center for Innovation in Advanced Development and Manufacturing (CIADM).**

Personalized Medicine

Personalized medicine uses individual genetic information to prevent disease, choose medicines and make other decisions about health. Pharmacogenomics, which underlies the promise of personalized medicine, is the study of the ways genetic variations affect drug responses. Researchers are interested in the use of gene-based tests to match patients with optimal drugs and dosages. This concept is beginning to have a powerful impact on treatments, especially for cancer.

Dr. Patrick Hwu has developed an individualized approach to melanoma treatment at the M.D. Anderson Institute for Personalized Cancer Therapy in Houston, Texas.

TEXAS RESEARCH CENTERS

University of Texas (UT) M.D. Anderson Cancer Center, Sheikh Khalifa Bin Zayed Al Nahyan Institute for Personalized Cancer Therapy (IPCT) —Houston

A division of the world-renowned M..D. Anderson Cancer Center, the IPCT's mission is to transform cancer therapy through research, by integrating germline, molecular, and genetic information with disease-specific biology to bring personalized cancer therapy to the clinic. www.mdanderson.org

$150 million

Amount of a single gift donated in 2011 to the UT M.D. Anderson ***Institute for Personalized Cancer Therapy*** *from the President of the United Arab Emirates, Sheikh Khalifa bin Zayed Al Nahyan. It is the largest grant ever received by M.D. Anderson.*

UT Health Science Center (UTHSC) San Antonio Cancer Therapy and Research Center (CTRC), Institute for Drug Development (IDD)

The CTRC is a National Cancer Institute designated cancer center, one of four in Texas, and a distinction held by only the top-tier cancer centers nationwide. A leader in developing new drugs to treat cancer, the CTRC's IDD conducts one of the largest oncology Phase I clinical drug programs in the world, and participates in development of cancer drugs approved by the U.S. FDA. www.ctrc.net

Texas A&M Institute for Genomic Medicine (TIGM)—College Station

TIGM maintains the world's largest library of mouse knockout embryonic stem cells. By facilitating translational research using functional genomics, scientists at TIGM are pioneering the development of medical breakthroughs and advancing personalized medicine on a global scale. www.tigm.org

UT Health Science Center (UTHSC), Center for Human Genetics—Houston

Research of key faculty includes pharmacogenomics and personalized treatments related to hypertension and cardiovascular disease. www.uthouston.edu/imm/centers/human-genetics.htm

The Methodist Hospital Research Institute (TMHRI)—Houston

Key staff at this research arm of Houston's Methodist Hospital are conducting research that combines genomics and advanced mathematical algorithms to identify the best combination of drugs for specific types of cancer in certain individuals, as well as accurate dosing in renal transplant recipients. www.methodisthealth.com/TMHRI

University of Houston Law Center, Health Law & Policy Institute

Key faculty research specialties and research activities include genetic information and pharmacogenetic testing. www.law.uh.edu/healthlaw/

EXAMPLE TEXAS COMPANIES

Asuragen (Austin)

Asuragen, formed in 2006 as a spin-off of the highly successful firm Ambion, is a fully integrated molecular diagnostics company and leader in personalized molecular diagnostics focused on oncology and companion diagnostics with special capabilities in the area of mRNA and miRNA. Its clients include top pharmaceutical and biotech companies. www.asuragen.com


Asuragen

Luminex (Austin)

Luminex offers a wide range of diagnostics and research assays throughout the areas of infectious diseases, human genetics and personalized medicine. www.luminexcorp.com

Caris Life Sciences (Dallas)

Caris is a leading provider of technologies for pathology, molecular profiling, and blood-based diagnostics. Among other services, the company provides customized molecular profiles of an individual patient's tumor, including biomarkers that indicate potential effectiveness of specific treatments. A comprehensive database matches potential treatments to the patient's unique tumor profile. www.carislifesciences.com/

Nanomedical Systems (NMS) (Austin)

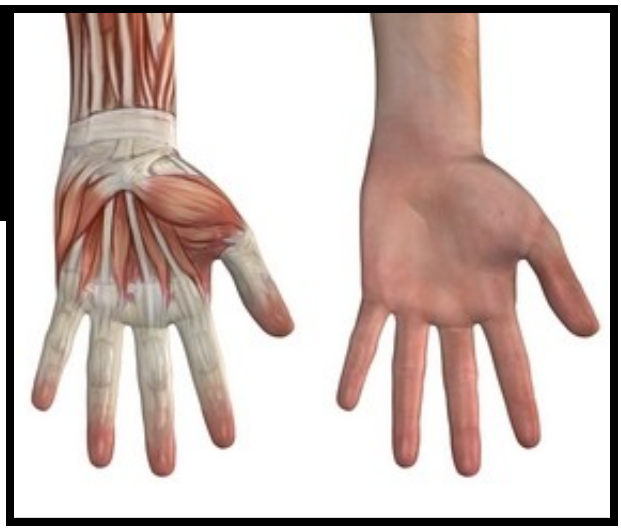
NMS is developing an implantable Personalized Molecular Drug-delivery System for the long-term, consistent release of therapeutic agents. www.nanomedsys.com/

RECENT DEVELOPMENTS

In March 2013, **Luminex** and global healthcare leader **Merck** signed an agreement to develop a companion diagnostic devices to identify patients at increased risk for developing Alzheimer's Disease. Luminex considers the development an expansion of the companion diagnostic segment of its personalized medicine portfolio.

In July 2012, **Luminex** purchased California-based molecular diagnostics company GenturaDx for $50 million in cash.

Regenerative Medicine



Over the past 50 years, organ transplantation and tissue repair faced major obstacles: insufficient supplies and the body's natural rejection of foreign matter. Three decades of research into stem cells and tissue engineering are now yielding tools to combat these obstacles in the form of regenerative medicine. Research institutions are gaining the capability to create personalized organs in the laboratory that match a patient's specific genetic makeup, relieving the pressure of finding a donor.

TEXAS RESEARCH CENTERS

Texas A&M Health Science Ctr. (HSC), Institute for Regenerative Medicine (IRM)—Temple

Established in 2008 as a joint venture between the Texas A&M HSC, Scott & White Hospital, and the Temple Bioscience District, the IRM brings together researchers and clinicians to coordinate efforts in studying adult stem cells and developing regenerative medical therapies. In 2009, the Texas Emerging Technology Fund (TETF) invested $5 million in the institute to recruit world-class researchers, such as IRM's director, Dr. Darwin Prockop, an internationally recognized pioneer in the area of human bone marrow-derived stem cells. medicine.tamhsc.edu/irm

The Texas Emerging Technology Fund invested $5 million in Texas A&M's Institute for Regenerative Medicine

Baylor College of Medicine, Stem Cells and Regenerative Medicine Center (STaR)—Houston

Founded in 2005 by Dr. Margaret Goodell, recipient of the 2011 O'Donnell Award in Medicine, the STaR Center focuses on stem-cell stimulation to regenerate tissues and the use of stem cells to repair damaged tissue. The center also specializes in tumor stem cells in relation to cancer relapse. www.bcm.edu/star

Rice University, Dept. of Bioengineering (DB)—Houston

Rice DB Professor Antonios Mikos' 25 patents and over 450 publications on tissue engineering and biomaterials document the success of the research center, The Mikos Research Group, he founded in 1998. Dr. Mikos has helped train almost 100 Ph.D. and post doctoral students and has led to groundbreaking research on biomaterials such as tissue regeneration scaffolds. www.ruf.rice.edu/~mikosgrp

Univ. of Texas (UT) M.D. Anderson Cancer Center, Tissue Regeneration and Molecular Cell Engineering Lab (TRAMCEL)—Houston

TRAMCEL couples multiple disciplines, such as biomedical engineering and nanotechnology, to advance tissue regeneration in repairing the physical damage caused by cancer or its treatment. Applications include repairing mandible defects from neck cancer, breast reconstruction after breast cancer, and repairing damaged trachea from throat cancer. www.mdanderson.org

South Texas Blood & Tissue Center (STBT), GenCure—San Antonio

Launched in August 2011, GenCure is a non-profit arm of the STBT focused on providing cell and tissue services for regenerative medicine, including patient treatment and clinical research on a national and global basis. GenCure has already teamed up with a number of researchers and is involved in multiple clinical trials in the U.S. as well as other parts of the world, including Brazil and China. www.bloodntissue.org/Home/GenCure.aspx

Armed Forces Institute of Regenerative Medicine (AFIRM), Fort Sam Houston—San Antonio

AFIRM is a multi-institutional, interdisciplinary network with public and private funding working to advance the groundbreaking developments of regenerative medicine for injured veterans and service members. Major program areas include limb repair, craniofacial repair, burn repair, scarless wound repair, and compartment syndrome repair. www.afirm.mil


America Stem Cell

EXAMPLE TEXAS COMPANIES

SpineSmith (Austin), **Celling Biosciences** (Austin)

SpineSmith designs, develops and markets implants and biologics for surgical fixation, correction, and tissue regeneration of the spine, while the firm's subsidiary Celling Biosciences develops tissue regeneration therapies utilizing adult stem cells, focusing its R&D on the areas of orthopedics, cardiovascular systems, trauma, plastics, and diseases. www.spinesmithusa.com www.cellingtechnologies.com

America Stem Cell (ASC) (Floresville)

ASC is developing and commercializing technologies to expand the therapeutic potential of bone marrow-derived stem cells. The company has strategic partnerships with a number of research institutions, including UT M.D. Anderson Cancer Center.
www.americastemcell.com/

RECENT DEVELOPMENTS

In February 2013, **Dr. C. Mauli Agrawal**, the David and Jennifer Spencer Distinguished Chair for the Dean of Engineering and Peter Flawn Professor in **Biomedical Engineering at UT San Antonio** (UTSA), was selected as the sole recipient of the Society for Biomaterials (SFB) 2013 Award for Service. Agrawal established UTSA's Dept. of Biomedical Engineering and serves as the Dean of UTSA College of Engineering. Agrawal's specialty is orthopedic and cardiovascular biomaterials and implants, with a primary interest in tissue engineering and regeneration.

In April 2012, the **Texas Medical Board** approved new guidelines for the use of experimental stem cell therapies, including regenerative medicine applications. The guidelines stipulate that the stem cell procedures are done for research only, that they receive approval from a public or private institutional research board, and that patients sign consent forms. Texas joins other states, such as California, New York, and Illinois, in the enactment of rules governing stem cell research.

Vaccines

Vaccines improve the body's resistance to disease by introducing weakened forms of a disease-causing organism. Most new vaccines do not consist of an entire virus or bacteria, only the antigen responsible for triggering an autoimmune response. Vaccines usually require special handling, syringes, and skilled professionals to administer them. Researchers are continuing to discover new applications for vaccines, as well as methods to improve production capabilities and delivery systems.

TEXAS RESEARCH CENTERS

Texas A&M University (TAMU), National Center for Therapeutics Manufacturing (NCTM)—College Station

NCTM aims to become the international leader for flexible manufacturing technologies applied to biological therapeutics – including personalized cancer vaccines. The facility includes approximately 10,500 sq. ft. of vaccine and pharmaceutical manufacturing space, 20 self-contained mobile clean room pods, and nearly 50,000 sq. ft. of educational space. nctm.tamu.edu

The new **Texas A&M Center for Innovation in Advanced Development and Manufacturing** opened in July 2012

Texas A&M Center for Innovation in Advanced Development and Manufacturing (CIADM)—College Station

In June 2012, the U.S. Dept. of Health & Human Services designated TAMU, in partnership with GlaxoSmithKline Vaccines, Kalon Biotherapeutics, and Lonza Group, to lead one of three national biodefense centers. Created as public-private partnerships, the centers will protect Americans from bioterrorism, natural pandemics, and other health threats. http://ciadm.tamus.edu

University of Texas Medical Branch at Galveston, Sealy Center for Vaccine Development (SCVD)

The SCVD's mission is to conduct research focused on the development and use of vaccines, develop public policy and education programs fostering vaccine acceptance, and train investigators in the field of vaccine research. Since being founded in December 2001, the SCVD has grown to incorporate more than 70 faculty members and 100 research programs from the university. www.utmb.edu/scvd

Texas Institute for Biomedical Research (Texas Biomed)—San Antonio

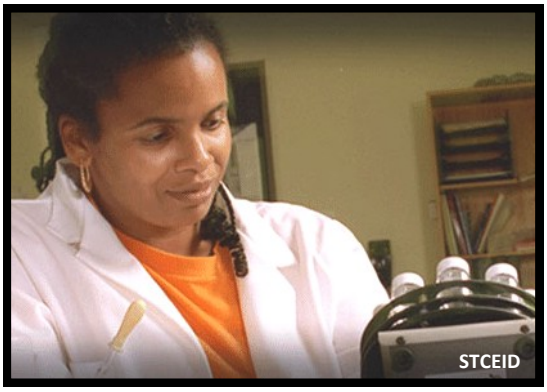
The Department of Virology and Immunology at Texas Biomed conducts research to develop vaccines and other therapeutics against some of the world's most harmful diseases. Unique resources at the institute include the nation's only privately owned biosafety level four (BSL-4) maximum containment lab and the Southwest National Primate Research Center, one of the world's largest centers for medical testing with non-human primates. txbiomed.org

Baylor Institute for Immunology Research (BIIR) —Houston

BIIR scientists conduct research on the immune system with a concentration on the role of dendritic cells in turning on and regulating immune responses. The institute is developing new therapeutic approaches related to cancer vaccines, autoimmune diseases, and infectious diseases.
baylorhealth.edu/Research/InstitutesCenters/BIIR/

UT San Antonio (UTSA), South Texas Center for Emerging Infectious Diseases (STCEID)

Vaccine development is one of the key research focuses at the STCEID, along with molecular microbiology, immunology, medical mycology, virology, microbial genomics and biodefense. One of the major areas of emphasis at STCEID is on the pathogenic mechanisms of emerging infectious diseases.
www.stceid.utsa.edu



UT Medical Branch at Galveston, Galveston National Laboratory (GNL)

The GNL is one of the nation's two National Biocontainment Laboratories and conducts research to develop therapies, vaccines, and diagnostic tests for naturally occurring emerging diseases such as SARS, West Nile encephalitis, and avian flu, as well as for microbes that might be employed by terrorists.
www.utmb.edu/gnl/

San Antonio Vaccine Development Center (SAVE)

Opened April 2012, SAVE is a collaborative center with partnering scientists from UT San Antonio, the UT Health Science Center (HSC) at San Antonio, Texas Biomed, and Southwest Research Institute. SAVE also includes military, industry, and government participants. The center works to create new vaccines to treat infectious diseases, biodefense activities, and to develop new approaches for quicker and more effective vaccine development.
savaccine.org

EXAMPLE TEXAS COMPANIES

Bellicum Pharmaceuticals (Houston)

Bellicum Pharmaceuticals received an investment of $1.45 million from the Texas Emerging Technology Fund to further its development of innovative treatments for patients with life threatening diseases. The company is developing new cancer therapies that are designed to give physicians greater control following the administration of a vaccine or drug.
www.bellicum.com

ALK Abello (Round Rock)

ALK is a global pharmaceutical company focused on allergy treatment, prevention and diagnosis. The company is a leader in the development of allergy vaccinations, which are designed to reduce and potentially eliminate the effects of an allergic reaction. Globally headquartered in Denmark, ALK's U.S. headquarters are located in Round Rock, TX.
www.alk-abello.com

RECENT DEVELOPMENTS

In March 2013, **Texas A&M University** and **GlaxoSmithKline** announced they will partner to create a $91 million world-class vaccination facility in College Station, Texas. The new facility will employ 200 to 300 and anchor the **Texas A&M Center for Innovation in Advanced Development and Manufacturing (CIADM).**

Diagnostics

Texas Veterinary Medical Diagnostic Laboratory

New biotech developments are leading to improved disease diagnosis, often increasing the speed or lowering the costs of existing diagnostic tests. Advanced diagnostics have the potential to improve an overall prognosis through early detection of disease. Diagnostics are also becoming more accessible and increasingly portable, allowing some tests to be completed in the home or at the point of care. Advances in genetics are allowing diagnostics to capture predisposition to certain diseases or to detect a disease early, before the display of symptoms.

TEXAS RESEARCH CENTERS

Baylor College of Medicine (BCM)—Houston

The Medical Genetics Laboratories at BCM have provided diagnostic services for more than 30 years. Facilities include a biochemical genetics lab, a cytogenetics lab, a DNA diagnostic lab, a mitochondrial lab, and a whole genome lab which, combined, allow for comprehensive diagnostic tests for a range of diseases and disorders. The John Welsh Cardiovascular Diagnostic Lab focuses on diagnostics for cardiovascular diseases. www.bcm.edu

The Texas Medical Center in Houston is the **world's largest medical complex**, with 54 member institutions, over 71,500 students, and 92,500 employees on **1,300 acres**

Texas A&M University, Texas Veterinary Medical Diagnostic Laboratory (TVMDL)

Headquartered in College Station, the TVMDL receives more than 220,000 requests annually for animal diagnosis, placing it among the busiest veterinary diagnostic labs in the world. TVMDL consists of two full-service labs in College Station and Amarillo, Texas, along with two poultry labs in Center and Gonzales, Texas. The laboratory is also home to two state Biosafety Level-3 veterinary diagnostic labs, which are designed to allow for the diagnosis of the most dangerous animal diseases. http://tvmdl.tamu.edu

The University of Texas Health Science Center at San Antonio (UTHSC), Molecular Diagnostics Laboratory (MDL)

The MDL is operated as a reference laboratory by the Department of Pathology at UTHSC at San Antonio. The lab conducts a range of molecular diagnostic tests to identify nucleic acid targets in different medical settings. The primary focus of the lab is on hematopathology, although molecular diagnostic tests are also conducted for other genetic and infectious diseases. http://strl.uthscsa.edu/molecular

The University of Texas, M.D. Anderson Cancer Center (MDACC) —Houston

Diagnostics play an essential role in the battle against cancer and researchers at the MDACC are continually exploring advances that can improve patient care. The Center's goal is to bring together leading researchers to focus on molecular-based approaches

to cancer detection and treatment. The Molecular Diagnostics Laboratory at MDACC is a certified clinical diagnostic facility specializing in oncologic molecular testing. It also serves as a referral laboratory for other hospitals and clinics. www.mdanderson.org

The University of Texas (UT), Southwestern Medical Center, Veripath Laboratories —Dallas

The Veripath Laboratories at UT Southwestern uses cutting edge techniques to help improve difficult diagnoses. It serves as a reference laboratory for the Center and community with expertise in multiple high-complexity testing areas. The lab offers molecular diagnositics, electron microscopy, flow cytometry, cytogenetics, and much more. www.utswmedicine.org/health-pros/veripath

EXAMPLE TEXAS COMPANIES

Admittance Technologies (San Antonio)

Founded by Dr. Marc D. Feldman, an internationally recognized cardiologist and research professor at UTHSC, Admittance Technologies is working to assist patients with heart disease through innovative electrical engineering solutions. The company is developing its CardioVol technology, which will allow for real-time blood volume measurement using existing pacemaker components to detect heart failure. http://admittancetechnologies.com

Caris Life Sciences (Irving)

Caris offers high-quality diagnostic, prognostic, and theranostic services to assist in battling complex diseases. Its specialties include anatomic pathology, molecular profiling and blood-based diagnostics. www.carislifesciences.com

Luminex (Austin)

Luminex develops and manufactures innovative biological testing techniques in the fields of diagnostics and the life sciences. The company's open-architecture xMAP® and xTAG® Technologies enable large numbers of biological tests (bioassays) to be conducted and analyzed quickly, cost-effectively and accurately. www.luminexcorp.com

Vermillion (Austin)

Vermillion produces high-value diagnostic tests that help physicians diagnose, treat and improve outcomes for patients. Vermillion and its prestigious scientific collaborators have ongoing programs in oncology/hematology, cardiology and women's health. The company is developing VASCLIR® in collaboration with Stanford University to aid physicians in the diagnosis of Peripheral Arterial Disease (PAD), a disorder affecting approximately 12 million Americans that is under-diagnosed and under-treated. www.vermillion.com

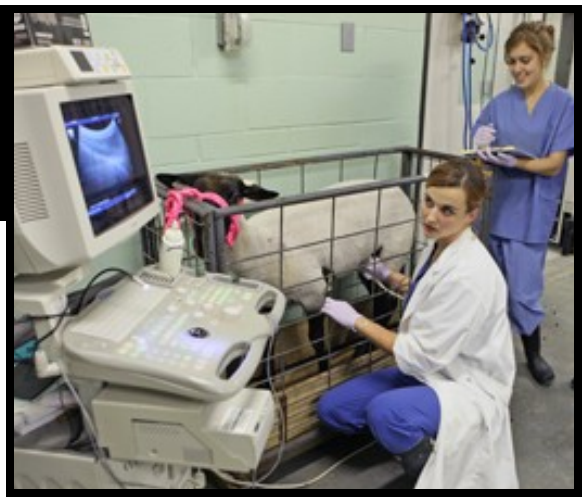
Luminex lab

RECENT DEVELOPMENTS

In March 2013, global healthcare leader **Merck** and **Luminex** signed an agreement to jointly develop a companion diagnostic device to identify patients at increased risk of developing Alzheimer's disease.

In February 2013, **Admittance Technologies** Inc. received $500,000 of a potential $1.99 million TETF award for the development and commercialization of its CardioVol technology.

Animal Biotechnology



Texas A&M College of Veterinary Medicine & Biomedical Sciences

Animal biotechnology encompasses a broad range of scientific principles for the genetic improvement of domesticated animal species, including cloning, selective breeding, artificial insemination, and genetic engineering. Utilizing animals in biotechnology can lead to progress and improvements in animal health, animal products, environmental conservation, and human health.

TEXAS RESEARCH CENTERS

Texas A&M Univ. (TAMU), Texas AgriLife Research, Dept. of Animal Science (DAS)—Bryan-College Station

TAMU's DAS has achieved national and international prominence as the largest and most complex department of animal science in the nation. Currently, disciplines within the department include reproductive physiology, animal breeding and genetics, food science, microbiology, equine science, dairy science, animal nutrition, and meat science. animalscience.tamu.edu

Texas A&M University operates the nation's largest and most complex department of animal science

Texas Tech Univ., Animal & Food Sciences, Burnett Center for Beef Cattle Research)—Lubbock area

Since 1984, Texas Tech scientists working at the Burnett Center have contributed extensively to human knowledge of beef cattle feeding and management. Major research areas include factors affecting animal growth and composition; evaluation of nutrient requirements of beef cattle; and grain and roughage processing. Future efforts include continued studies in these three major areas, with emphasis placed on feeding management systems, the economic and environmental sustainability of cattle production, and nutrition/health interactions in lightweight, stressed beef cattle. www.depts.ttu.edu/afs/burnett_center

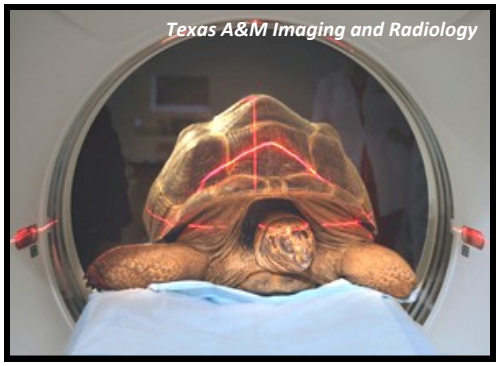
TAMU, College of Veterinary Medicine & Biomedical Sciences (CVMBS)—Bryan-College Station

The CVMBS focuses on six signature programs: infectious diseases and homeland security, genomics, toxicology and environmental medicine, cardiovascular sciences, neurosciences, and reproductive biology. Research includes the college's Biomedical Genomics group, which plays a leading role in the analysis of the genomes of livestock species and has one of the most robust animal genomics programs in the world. vetmed.tamu.edu

TAMU, The National Center for Foreign Animal and Zoonotic Disease Defense (FAZD Center)—College Station

The FAZD Center, headquartered at TAMU, performs research and develops products to defend the

nation from high-consequence foreign animal and zoonotic (transmissible between animals and humans) diseases. Founded in 2004 as a U.S. Dept. of Homeland Security Center of Excellence, the FAZD Center leverages the resources of multiple major universities, national laboratories, and partners in state and federal government. fazd.tamu.edu



The Univ. of Texas Health Science Center at San Antonio (UTHSCASA), Comprehensive Facility for Animal Imaging Research (CFAIR)—San Antonio

CFAIR operates within UTHSCSA's Research Imaging Center (RIC). CFAIR uses small-animal imaging to research the effectiveness of treatments for many types of diseases. Researchers aim to achieve in a few years with small animals what could take 50 to 75 years to study in humans. CFAIR was funded in part with a $4.1 million investment from the Texas Emerging Technology Fund in 2006, which leveraged a matching grant from the U.S. Dept. of Defense's Defense Advanced Research Projects Agency (DARPA). ric.uthscsa.edu/facilities.php

EXAMPLE TEXAS COMPANIES

Animal Innovations (Houston)

The Texas Emerging Technology Fund (TETF) has invested $1 million in Animal Innovations' technology, a novel medication injection system focused on improving the health and quality of beef cattle. Branded as PerfectDose, the intelligent dosage-injection system allows for highly accurate weight-based injections to large animals including cattle, horses, pigs and others. The product saves feedlot operators thousands of dollars annually on wasted medication due to current improper dosing methods. www.animalinnovations.com

OnTrack Imaging (Flower Mound)

OnTrack Imaging received $1 million from the Texas Emerging Technology Fund to produce and sell its ultrasound imaging system for the horse health industry. The company is completing its initial prototype production phase for a light-weight camera to use in clinical evaluations. The ultrasound camera will allow early diagnosis of compromised soft tissue and will ultimately provide veterinarians, trainers and owners detailed information about the condition of the tissue to help prevent serious injury to the equine athlete. www.ontrackimaging.com

Equitech-Bio (Kerrville)

Equitech-Bio is a San Antonio-area developer of animal serum processing and fractionation methods, supplying animal sera, albumins, plasma, and organs to research institutions and pharmaceutical and diagnostic manufacturers. www.equitech-bio.com

RECENT DEVELOPMENTS

In March 2013, the USDA National Institute for Food and Agriculture announced a five year, $3 million grant to study cow fertility. Infertility is considered one of the biggest barriers to global competitiveness for American dairy farmers. Dr. Pablo Pinedo, **TAMU AgriLife Research** ruminant animal health scientist in Amarillo, Texas, will lead the collaborative effort to develop a study that involves seven universities and 12 scientists. The TAMU **College of Veterinary Medicine** will also be involved.

Crop Biotechnology

Rice crop studies at Texas A&M AgriLife Research Beaumont

Farmers have relied for centuries on cross-breeding, hybridization, and other genetic modifications to improve the yield and quality of crops. Today's tools of biotech allow for a far more precise and selective process than traditional breeding techniques can offer. Crop biotechnology research is focused on increasing yields by making plants stronger and more resistant to pests and environmental stresses, as well as by developing biopesticides, herbicides, and other crop protections.

TEXAS RESEARCH CENTERS

Texas Tech University (TTU), Dept. of Plant & Soil Science, Center for Excellence of Agricultural Genomics and Biometrics (CEAGB)—Lubbock

In February 2006, the Texas Emerging Technology Fund (TETF) announced a $1.9 million investment to recruit Dr. Thea Wilkins, one of the world's premier cotton geneticists and currently director of TTU's CEAGB. The center is working on cotton DNA sequencing to improve the quality, strength, and length of cotton crops. www.pssc.ttu.edu

Texas is the **No. 1 cotton producing state** in the nation. In 2012, 91% of the cotton planted in Texas was genetically modified.

- U. S. Dept. of Agriculture

Texas A&M University (TAMU), Department of Soil and Crop Sciences (DSCS)—College Station

The DSCS is the largest such facility in the world with a global reputation. The department's mission is to develop technologies to sustain environmentally sound and economically profitable production systems; to ensure that extension of technological developments is effective and timely; and to promote the wise use, management, and stewardship of soil, plant and water resources. soilcrop.tamu.edu

Texas A&M University educates more graduates in agriculture-related fields than any institution in the U.S.

TAMU, Norman Borlaug Institute for International Agriculture—College Station

The Borlaug Institute is named for former TAMU professor Dr. Borlaug, a Nobel Laureate known as "the father of the green revolution." The institute's mission is support and implement international agricultural developments, train and educate, and serve as a collaborative research facility. borlaug.tamu.edu

TAMU, Texas AgriLife Research (TAR)

TAR is the state's premier research agency in agriculture, natural resources, and the life sciences,

with over $190 million in research funding, and thirteen Texas AgriLife Research and Extension Centers throughout the state. The centers areas of expertise include rice production and management; wheat breeding; integrated crop and livestock production systems; irrigation water management; crop physiology; plant pathology; soil fertility; plant disease and integrated pest management for grain crops. agriliferesearch.tamu.edu

EXAMPLE TEXAS COMPANIES

Stoller USA (Houston)

Stoller USA is a world leader in the development and sales of Plant Performance Products and is dedicated to helping producers enhance yields by maximizing genetic expression. Plant Performance is based on the use of plant hormones, supporting nutrients and other hormone co-factors designed to ensure optimum hormone balance and activity. www.stollerusa.com/

Smartfield (Lubbock)

Smartfield received a $1 million TETF grant in January 2010 to commercialize its SmartCrop® technology. The product uses sensors to monitor rainfall, crop canopy temperatures, and stress levels, and informs growers of the real-time irrigation demands of virtually any type of row crop. This method makes it easier for growers to determine the ideal conditions for watering crops, ultimately reducing pumping and labor costs, saving water and improving crop yields. www.smartfield.com/

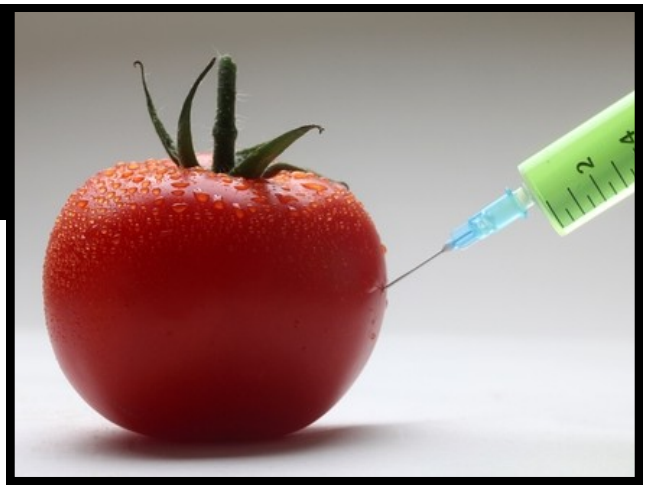
Monsanto (Lubbock)

In December 2010, multinational agribusiness giant Monsanto opened its $10.5 million "research megasite" in Lubbock, Texas. The **Monsanto Texas Cotton Breeding and Technology Center** provides a central point for the company's breeding and testing programs. Megasite is a term Monsanto uses to describe a research facility which houses multiple programs focused on improving genetic performance. Monsanto's Lubbock location exemplifies its commitment to the Texas cotton industry and to developing varieties adapted to the region, which produces more cotton than any other state. Missouri-based Monsanto has nine other Texas sites, including a research farm outside of Lubbock and testing centers in Haskell and near Corpus Christi. www.monsanto.com/

RECENT DEVELOPMENTS

In February 2012, **TAMU's Texas AgriLife Research** and **Bayer CropScience,** a division of German conglomerate **Bayer**, signed a multi-year agreement to develop and commercialize improved wheat varieties. Additionally, the collaboration will focus on the development of molecular breeding tools to facilitate the rapid genetic improvement of wheat. Utilizing Texas AgriLife Research's extensive collection of wheat cultivars and germplasm and Bayer's expertise in both classical and molecular plant breeding, the collaboration aims to bolster current development efforts and expedite the delivery of higher yielding wheat varieties to market. Financial details of the collaboration were not released.

Food Biotechnology



Biotechnology provides new tools for improving animal health and welfare, increasing livestock productivity, increasing crop yields, developing farming practices that benefit the environment, and increasing agricultural sustainability. Food producers can use biotechnologies to produce new products with desirable characteristics, such as disease and drought resistance in plants, leaner meats, and enhanced flavor and nutritional quality of processed foods.

TEXAS RESEARCH CENTERS

Southwest Research Institute (SwRI)—San Antonio

SwRI has been active in food-related science for more than 60 years, developing innovative formulation, analysis, and engineering solutions for the food processing and manufacturing industries. Specific areas of research include micro/nanoencapsulation, particle engineering, nanomaterials, antimicrobial materials, analytical chemistry, testing and failure analysis, materials engineering for food applications, and manufacturing systems. swri.org

Texas leads the nation in farm-raised shrimp production, generating more than 89% of the U.S. total

- USDA's Census of Aquaculture

Texas A&M Univ. (TAMU), Food Protein R&D Center (FPRDC)—College Station

The FPRDC is one of the oldest agricultural research and service centers in the nation, with a focus on developing crops and animal products into food, feed, and industrial ingredients. Unique services of the center include oil mill research, pilot plants for edible oils and vegetable food proteins, and a membrane separations lab. foodprotein.tamu.edu

TAMU, Vegetable & Fruit Improvement Center (VFIC)—College Station

The VFIC's goal is to strengthen the vegetable industry through research and development of new technologies for producing vegetable products in an efficient and environmentally sound system, with a focus on achieving health and nutrition benefits. Research activities at the center include nutrition science, breeding, molecular genetics, pre- and post-harvest technologies, and the isolation and characterization of bio-active molecules. vfic.tamu.edu

Texas Tech University (TTU), Department of Animal & Food Sciences (AFS)—Lubbock

The AFS focuses on a range of fields including food science, food safety, muscle biology, animal breeding, genetics, and physiology, with specializations in cattle, horse, sheep, goats, poultry, and swine. TTU research institutes include the International Center for Food Industry Excellence, the Pork Industry Institute, and the Burnett Center for animal feed studies. www.depts.ttu.edu/afs

TAMU, Texas AgriLife Research and Extension Centers (AREC), Mariculture Labs—Corpus Christi

TAMU's AREC program operates two mariculture labs in the Corpus Christi area. The Flour Bluff lab's research focuses on improving food shrimp production and identifying aquatic species for biofuel production. The Port Aransas lab pursues advances in the commercial shrimp and sea urchin farming industries, with an emphasis on technology transfer between private industry and public institutions. ccag.tamu.edu


Texas A&M Food Protein R&D Center

EXAMPLE TEXAS COMPANIES

Analytical Food Laboratories (AFL) (Grand Prairie)

AFL provides third-party microbiological, chemical, nutritional and physical analysis on an array of foods, water, cosmetic, and pharmaceutical products. Its microbiology department conducts a range of quantitative and qualitative food tests, spore counts, and bacterial identification, while its chemistry department tests ingredients, certified organics and processed foods. www.afltexas.com

EnteroLab (Dallas)

EnteroLab is an accredited clinical lab that analyzes intestinal specimens to discover human food sensitivities that may be causing illness or disease. Specialties include analysis of gluten sensitivity, microscopic colitis, yeast sensitivity, and other causes of intestinal disease. www.enterolab.com

Food Safety Net Services (FSNS) (San Antonio)

FSNS operates a network of accredited laboratories around the country that provide microbiological testing, chemical analysis and nutrition labeling assistance. FSNS chemistry lab capabilities include testing for proximate, additives, carbohydrates, sweeteners, minerals, metals, fats, oils and allergens. Microbiological capabilities include pathogen detection, microbial toxins, and allergens. www.food-safetynet.com

Omega Protein Corp. (Houston)

Omega Protein develops, produces, and globally distributes nutritional products including highly-refined omega-3 rich fish oil, specialty proteins, and nutraceuticals. The company is the world's largest producer of omega-3 fish oil and one of the country's largest fishing companies. Its OmegaPure Technology and Innovation Center researches and develops new applications for omega-3 fatty acids in food and beverage applications. www.omegapure.com

RECENT DEVELOPMENTS

In October 2012, **TAMU** opened **The Center for Food Safety,** a new state-of-the-art laboratory equipped with instrumentation to allow rapid food-borne pathogen testing and characterization at The Science Park in College Station. The lab is equipped with instrumentation from leaders in the food testing industry, such as bioMerieux, BioControl, Neogen and Roka Bioscience. The center's goal is to facilitate the recognition of TAMU as a leader in food safety research.

Biofuels

Fueled by higher oil prices, concern over the effects of greenhouse gas, and the increased importance of energy independence, biofuels have gained intense research support in recent years. These fuels are derived from biomass resources such as plant materials and animal waste. According the International Energy Agency, biofuels production capacity has grown from 4.2 billion gallons in 2000 to over 26.4 billion gallons in 2011.

TEXAS RESEARCH CENTERS

Texas A&M University (TAMU), Bioenergy and Bioproducts Research (BBR) Program—Bryan-College Station

The BBR Program is located within TAMU's Texas AgriLife Research (TAR) and encompasses a wide spectrum of innovation, from developing high-tonnage biomass plants at the molecular level to developing more efficient processes to manufacture biofuels. Areas of research include: biodiesel, ethanol, oilseeds for biofuels, purpose-designed crop plants for biofuels, pyrolysis, and microalgae ponds. www.energyengineering.org/bioenergy

Texas is the **No. 1** biodiesel producing state and one of the top 15 for ethanol production

TAMU, TAR, General Atomics Biofuels Program—Pecos

The U.S. Air Force, TAR, and California-based high-tech firm General Atomics are working together at the TAR Station in Pecos, Texas, to demonstrate the commercial viability of large-scale bio-oils and biofuels production from microalgae feedstock. In 2008, the Texas Emerging Technology Fund (TETF) invested over $4 million through a research matching grant to assist the project toward its goal of commercializing algae-derived transportation fuels. The algae biofuel test center in Pecos, Texas, is considered a world-class facility. http://algaeforfuel.agrilife.org/gabiofuels/

Southwest Research Institute (SwRI), International Alternative Fuel Technology Center (IAFTC)—San Antonio

SwRI's IAFTC specializes in the investigation and characterization of emissions from alternative fuels and the registration of alternative fuels and fuel additives. SwRI has extensive experience in producing and analyzing conventional and alternative fuels, fluids, lubricants, and utilizing microbial and biological techniques. www.swri.org/4org/d03/altfuels/default.htm

UT Austin, Webber Energy Group (WEG)

UT Professor Michael Webber's research group, WEG, is a multidisciplinary program at UT Austin that bridges the divide between policymakers and scientists on issues related to energy and the environment. Algae-Based Biofuels, one of several ongoing projects, is sponsored by the U.S. EPA, the Robert S. Strauss Center, the Center for Electromechanics, the

Energy Foundation, and OpenAlgae, a UT spinoff. Research includes an analysis of innovative feedstock sources and production technologies for renewable fuels. www.webberenergygroup.com


Ponds at Texas A&M algae biofuel station, Pecos, TX

UT Austin, UTEX The Culture Collection of Algae (UTEX)—Austin

UTEX maintains one of the world's largest algae collections, with nearly 2,800 strains. The collection operates as a non-profit with support from the National Science Foundation and UT. UTEX supplies algae strains globally for research, biotech development, and a variety of other purposes. web.biosci.utexas.edu/utex/

EXAMPLE TEXAS COMPANIES

Photon8 (Brownsville)

In 2010, Photon8 received a $1 million award from the TETF to genetically enhance the performance of algae and apply it to the manufacturing of alternative fuels. The company is working in partnership with UT at Brownsville and Texas Southmost College to produce low-cost algae biofuels. www.photon8.com


Photon8

OpenAlgae (Austin)

OpenAlgae works closely with a multi-disciplinary development team at UT Austin's Center for Electrome-chanics to commercialize technologies that will cost-effectively process algae to produce oil and useful byproducts. The company has developed a proprietary low-cost algae processing solution that is largely species-agnostic. www.openalgae.com

Environmental Quality Management Associates (EQMA) (Dallas)

EQMA is a 2008 TETF recipient that has developed an enzymatic process to convert food-product waste and animal manure into 99%-pure ethanol. EQMA is focused on working with CAFOs (concentrated animal feeding operations) and municipal waste facilities. http://eqma.net/

RECENT DEVELOPMENTS

In October 2012, Iowa-based **Renewable Energy Group (REG)** purchased an idled 15 million gallon per year biorefinery near New Boston, Texas. The facility, 22 miles west of Texarkana, was upgraded before resuming operations in early 2013. REG plans to create approximately 20 new jobs in Texas and to use animal fats and other fatty acid feedstocks to increase its total production to over 225 million gallons annually. The New Boston plant is REG's second Texas biodiesel production facility, following the 2008 purchase of a Houston-area plant. REG is one of the nation's largest biodiesel producers, with a nationwide distribution and logistics system.

Bioplastics
& Industrial Biomaterials

Biomaterials are composed of renewable agricultural products and offer the ability to replace petroleum-derived plastics and other industrial materials with products derived from biomass like grain. Similar to ethanol, green plastics are made in biorefineries, where sugar from plant material is used in place of petroleum-based chemicals to create industrial polymers.

TEXAS RESEARCH CENTERS

Texas Tech University (TTU), Dept. of Plant and Soil Science, Fiber and Biopolymer Research Institute (FBRI)—Lubbock

FBRI works to further the understanding of cellulose and other plant-based biopolymers with special emphasis on cotton. Because cotton is a pure form of natural cellulose, the institute believes the crop can serve as a useful model for other plant-based biopolymers. FBRI research is intended to functionalize materials such as bioplastics by imbuing them with new properties. www.itc.ttu.edu/fbri

Texas is home to the largest U.S. manufacturer of compostable, **bioplastic trash bags** and can liners

TTU, School of Engineering, Composites and Plastics Lab (CPL)—San Marcos

The CPL studies advanced polymers. Ongoing research focuses on bio-based composite material that could be used instead of traditional composites, including reinforced bio-based polyurethane composites and nano-composites, as well as enhancements to the mechanical properties of reinforced biobased composites by improving fiber/matrix adhesion. http://composites.engineering.txstate.edu/

University of North Texas (UNT), Renewable Bioproducts Research Cluster (RBRC)—Denton

In February 2011, UNT selected Dr. Stevens Brumbley, a well-known bioengineer with expertise in plant metabolic engineering, as the first senior hire for the RBRC. Dr. Brumbley's expertise lies in engineering plants, specifically sugarcane, to produce a range of industrial bioplastics and bioplastic precursors, which will provide alternatives to petrochemical-based plastics. The RBRC group of researchers, working with academic colleagues, industries, government agencies, and international colleagures, is exploring the creation of green solutions that outperform their non-renewable counterparts.
http://renewablebioproducts.unt.edu/

UNT, Dept. of Materials Science and Engineering—Denton

Led by Professor Nandika Anne D'Souza, an expert in polymer nanocomposites, **UNT's Polymer Mechanical and Rheology Laboratory** researches bioplastic materials with the goal of creating new,

greener products that match the performance of conventional plastics, cardboard, paper coatings, fiberglass, and foams. Among other projects, the lab team has spent several years studying the fibers produced by kenaf, a plant in the hibiscus family, as an alternative to glass and synthetic fibers. www.mtse.unt.edu

EXAMPLE TEXAS COMPANIES

Heritage Bag Company (Carrollton)

Heritage Bag is the largest U.S. manufacturer of compostable trash bags, can liners, and kitchen compost bags. The company's Bio-Tuf compostable trash bags, made from sugar-based bioplastic, break down along with other organic trash in an actively managed compost facility. www.heritage-bag.com

Accredo Packaging (Sugar Land)

Accredo manufactures and supplies sustainable flexible packaging predominantly for the pre-packaged foods and consumer products markets in North America. The company is a recognized leader in sustainable flexible packaging innovation, offering biopolymer products manufactured from renewable and biodegradable components with barrier performance matching those of conventional products. www.accredopackaging.com

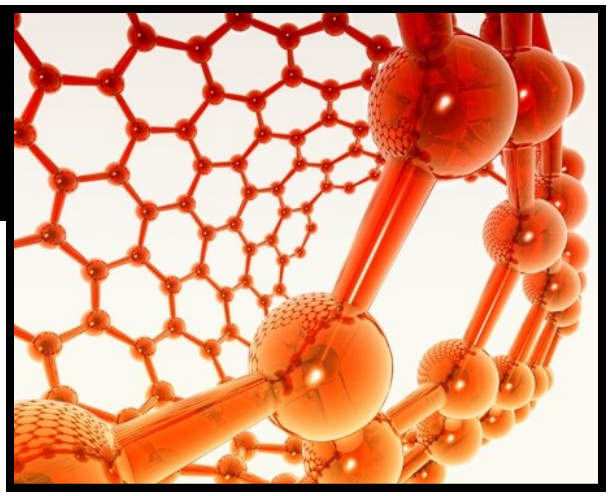
RECENT DEVELOPMENTS

The **City of Houston,** one of the nation's largest metropolitan areas, implemented its **Compostable Bag Program** for yard trimmings in April 2010. The Houston City Council approved this change in 2009 in order to keep reusable yard wastes out of landfills and save substantial amounts of money. City residents can purchase from a selection of city-approved waste bags made from compostable polymers or other renewable resources. For program details, see www.houstontx.gov/solidwaste/compostablebags.html.

Frito-Lay's bioplastic chip package

In 2010, Plano, TX-based **Frito-Lay** introduced the world's first compostable snack chip bag for its Sun Chips brand. The bioplastic packaging is made of corn-based PLA (polylactic acid) by NatureWorks LLC, the largest U.S. producer of bioplastics. Frito-Lay introduced a redesigned and quieter version of the compostable packaging in 2011.

Nanobiotechnology



Nanobiotechnology is an emerging field that links the advances in nanotechnology and molecular biology. The field focuses on the development of devices to study biological systems or to be utilized in biological structures, such as DNA, to create the next generation of computers. Examples included using nanoparticles as drug delivery systems or as sensors in biological assays to detect medical conditions like cancer. Nanobiotechnology also includes the study of biotechnology at the nanoscale, such as DNA or cellular engineering.

TEXAS RESEARCH CONSORTIA

The Alliance for Nanohealth (ANH)—Houston

Formed in 2005, the ANH is a consortium that aims to bring nanotechnology to the medical and healthcare mainstream. It is the first multi-disciplinary, multi-institutional collaborative research endeavor aimed solely at using nanotechnology to bridge the gaps between medicine, biology, materials science, computer technology and public policy. The Alliance is comprised of eight world-class research institutions (see graphic, below), with scientists and clinicians located within the Texas Medical Center and the greater Houston region.
allianceforanohealth.org/

The Methodist Hospital Research Institute (TMHRI)—Houston

TMHRI is an interdisciplinary effort directly affiliated with The Methodist Hospital System, as well as with other major U.S. and international academic institutions including Cornell University, the University of Houston, Tel Aviv University in Israel, and Monterrey Tech in Mexico. TMHRI's 1,300 credentialed researchers are led by Dr. Mauro Ferrari, who also serves as President of ANH. TMHRI's **Department of Nanomedicine** focuses on inter-disciplinary research to combine nano-engineering, mathematical modeling and biomedical sciences to develop nanotechnology enabled therapeutic and diagnostic platforms for combating diseases including cancer, cardiovascular diseases and infectious diseases.
methodisthealth.com/nanomedicine

TEXAS RESEARCH CENTERS

Rice University, Center for Biological and Environmental Nanotechnology (CBEN)—Houston

CBEN is overseen by Rice University's Richard E. Smalley Institute for Nanoscale Science and Technology. The center focuses on nanomaterials R&D to enable new medical and environmental technologies, with particular emphasis on nanoparticles that detect and treat disease and nanomaterials for high-performance water purification systems. cben.rice.edu

The University of Texas (UT) at Dallas, Alan G. MacDiarmid NanoTech Institute (AMNT)—Richardson

The AMNT's nanobiotech research areas include carbon nanotube artificial muscles, which researchers have demonstrated provide a hundred times the force generation capability of natural muscles, and carbon nanotube/biological molecule composites, in which the interactions of designer proteins and nanotubes are investigated for various applications including sensors and drugs. nanotech.utdallas.edu

UT Arlington, Nanotechnology Research & Education Center (NanoFab)—Arlington

NanoFab is an interdisciplinary R&D and teaching facility open to scientists within the university, as well as investigators at other universities and in the private sector. The center includes the Nano-Bio Lab, which focuses on the sensing and detection of biological targets and interactions using novel solid state devices and aims at the development of specific and ultrasensitive nanoscale biosensors and systems. www.uta.edu/engineering/nano

EXAMPLE TEXAS COMPANIES

Azaya Therapeutics (San Antonio)

Azaya received a $1.045 in Texas Emerging Technology Fund (TETF) funding in 2009 to commercialize its innovative nanotechnology drug delivery platform for cancer treatment. www.azayatherapeutics.com

NanoSpectra Biosciences (Houston)

Co-founded by Rice Professor Dr. Naomi Halas, NanoSpectra Biosciences received $1.25 million in TETF funding in 2006 to commercialize its oncologic imaging detection using nanoparticles. The company's AuroLase Therapy is a novel medical device that is broadly applicable to many solid tumors. www.nanospectra.com

RECENT DEVELOPMENTS

In 2012, the U.S. Food and Drug Administration approved a clinical study in which **Azaya Therapeutics** will test the efficacy of its drug delivery system with its generic version of the popular cancer drug Doxil in patients with ovarian cancer. Azaya manufactures ATI-0918, a generic version of Doxil, which is owned by Johnson & Johnson. Azaya expects to have the study results by mid-2013, after which it will seek regulatory approval for ATI-0918.

Bioinformatics & Computational Biology

Bioinformatics is the intersection of computer science, mathematics, and life science. The field addresses the problems of collecting, and visualizing the massive amounts of data generated by biotech research, by utilizing databases, algorithms, and statistical techniques. Common applications include mapping DNA sequences or creating 3-D models of protein structures.

TEXAS RESEARCH CENTERS

The Gulf Coast Consortia (GCC) for Quantitative Biomedical Sciences)

The GCC is comprised of six prominent Houston-area institutions: Baylor College of Medicine, Rice Univ., Univ. of Houston, Univ. of Texas (UT) Health Science Center at Houston, UT Medical Branch at Galveston, and UT M.D. Anderson Cancer Center (MDACC). Its goal is to harness the training and research strengths of all the member institutions within faculty clusters such as Bioinformatics, Mathematical Biosciences, and Computational Neuroscience. www.gulfcoastconsortia.org

Baylor College of Medicine, Bioinformatics Research Laboratory (BRL)—Houston

The BRL develops new experimental and computational methods for discovery through genomics, epigenomics, and informatics. brl.bcm.tmc.edu

Univ. of Houston, Center for Biomedical and Environmental Genomics (CBMEG)

The CBMEG has a fully equipped molecular biology lab and specializes in next-generation sequencing and analysis. www.bioinfo.uh.edu

UT MDACC, Dept. of Bioinformatics and Computational Biology (BCB)—Houston

The BCB conducts collaborative research with clinical and basic science departments and supports the need for quantitative sciences in genomics, proteomics, radiotherapy, molecular and cell biology, and computer-assisted diagnosis and image analysis. bioinformatics.mdanderson.org/main/

Rice Univ., Dept. of Biochemistry and Cell Biology (BCB), Bioinformatics & Computational Biology (BICB) Program—Houston

BICB is one of the research areas within Rice's BCB department. Bioinformatics applications include the use of functional genomics to describe the dynamic aspects of genes within a related cluster or pathway, to design synthetic circuits, and to make computational predictions of genetic interactions based on databases of experimentally-derived interaction data. biochem.rice.edu

UT Medical Branch (UTMB) at Galveston, Bioinformatics Program

UTMB's bioinformatics program offers expertise, training, and analytical support in computational

biology and bioinformatics to UTMB researchers. These activities include developing analytical software, data warehousing, data mining, and high-level multivariate analysis. www.bioinfo.utmb.edu/

UT Austin, Center for Computational Biology and Bioinformatics (CCBB)—Austin

The CCBB provides research support for students and faculty using computational approaches to solve biological problems. Research areas include computational phylogenetics, nucleic acid structure, and molecular evolution. ccbb.biosci.utexas.edu

Texas A&M Univ., Alliance for Bioinformatics, Computational Biology, and Systems Biology—College Station

The Alliance brings together A&M researchers in the areas of bioinformatics, computational biology and systems biology to facilitate synergistic research and educational activities. abcs.tamu.edu

UT El Paso (UTEP), Bioinformatics Computing Laboratory (BCL)—El Paso

The BCL serves as a core facility of UTEP's Border Biomedical Research Center (BBRC). The lab is funded by the National Institutes of Health and provides bioinformatics research support to the border region. www.bioinformatics.utep.edu

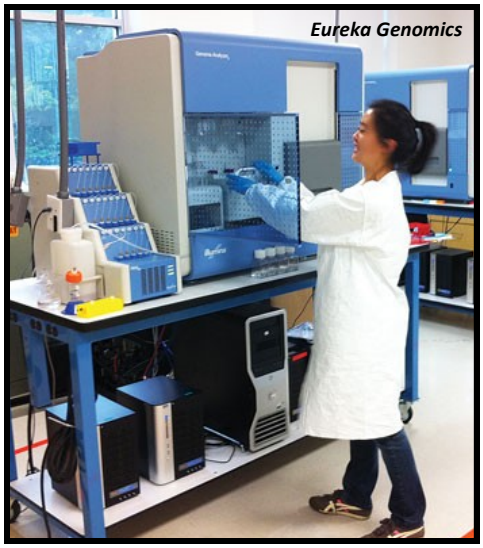
EXAMPLE TEXAS COMPANIES

Smart Imaging Technologies (SIT) (Houston)

The Texas Emerging Technology Fund awarded SIT $1 million to commercialize its hardware and software system, which automatically identifies water borne pathogens during water analysis tests mandated by the EPA and the Safe Drinking Water Act. The company's products also enable data analysis, imaging, and 3D modeling for plants, insects, and human tissue. www.smartimtech.com

Eureka Genomics (Sugar Land)

Eureka is a leader in advanced bioinformatics analysis of next-generation sequencing data, which it applies to the discovery of microorganisms associated with cancers and other life threatening diseases, the development of molecular diagnostics, and low density marker assays. www.eurekagenomics.com


Eureka Genomics

Seralogix (Austin)

Seralogix's proprietary BioSignatureDS bioinformatics software, combined with export services, offers customized solutions for systems biology data analysis. The software's algorithms use powerful methods of machine learning and pattern recognition to decode the complexities of biological systems. www.seralogix.com

RECENT DEVELOPMENTS

In May 2012, bioinformatics firm **Eureka Genomics** was awarded a multi-year forensics contract with the Armed Forces DNA Identification Laboratory to identify remains from the Korean War. Later, in June 2012, the USDA' National Institute of Food and Agriculture (NIFA) awarded Eureka $100,000 for the development of Bovine Parentage Genotyping by Highly Multiplex Next Generation Sequencing. California-based Eureka's bioinformatics operations are located in Sugar Land, TX.

Biotechnology in Microgravity

NSBRI ultrasound program on the International Space Station

Microgravity biotech research focuses on three principal areas: protein crystal growth, mammalian cell and tissue culture, and fundamental biotechnology. There are many advantages to conducting research under conditions where the apparent weight of the experiment system is reduced. In microgravity, protein crystal growth is structurally better and larger, and mammalian cell and tissue cultures are not subject to separation, giving researchers a more three-dimensional look at cells.

TEXAS RESEARCH CENTERS

National Space Biomedical Research Institute (NSBRI)—Houston

The NSBRI is a unique non-profit research consortium established in 1997 by NASA. It consists of over 70 agencies, universities, and institutions to develop health-related solutions to support long-duration human space exploration. The NSBRI is governed by a consortium of 12 U.S. institutions, including Texas-based Baylor College of Medicine (the lead institution), Rice University, and Texas A&M University. The institute's research addresses key technologies required to enable and enhance exploration. In particular, NSBRI scientists and physicians are developing technologies to provide medical monitoring, diagnosis and treatment in the extreme environments that will be faced during exploration missions. NSBRI discoveries also impact medical care on Earth. The institute works to transfer its space health solutions to patients suffering from similar conditions, including osteoporosis, muscle wasting, shift-related sleep disorders, balance disorders and cardiovascular problems. NSBRI funds more than 60 peer-reviewed science, technology, and education projects at leading institutions across the nation. www.nsbri.org

NASA's **National Space Biomedical Research Institute** in Houston is a world leader in translational space biomedical research

Baylor College of Medicine (BCM), Center for Space Medicine (CSM)—Houston

Established in 2008, CSM partners with the NSBRI, Rice University, and NASA to provide a unique, interdisciplinary academic program engaging investigators, physicians, students and others in the fields of biomedical science and medicine. The CSM works to foster biomedical discovery, enhance the field of space medicine, and train space biomedical scientists and physicians of the future. The Center's goal is to be an international leader in space biomedical research and education, and to excel in discoveries relevant to life both in space and on Earth. bcm.edu/spacemed

Rice University, BioScience Research Collaborative (BRC)—Houston
The BRC is an innovative space where scientists and educators from Rice University and other Texas Medical Center institutions work together to perform leading research that benefits human medicine and health, including space-related biomedical research (see Recent Developments for details). brc.rice.edu/

EXAMPLE TEXAS COMPANIES

Astrogenetix (Austin)

Astrogenetix has gained expertise through the use of microgravity and sending over 1,500 NASA science experiments into space. The company is positioned to help commercialize products derived from microgravity discoveries, including therapeutically relevant and commercially viable biomarkers. Due to unique laboratory conditions created in microgravity, the company finds novel biomarkers that may not be identifiable via terrestrial experimentation and may shorten the drug development timeframe. Astrogenetix is one of the first commercial entities to hold a Space Act Agreement with NASA for use of the International Space Station, a designated U.S. National Laboratory, for research, development and industrial processing purposes.
www.astrogenetix.com

RECENT DEVELOPMENTS

In August 2012, Houston-based **National Space Biomedical Research Institute (NSBRI)** renewed awards for its Graduate Education Program in Space to **Texas A&M University** for $1 million over a five-year period. This innovative educational program allows participating students to work toward a Ph.D. focused on space life sciences.

Starting in May 2012, Houston-based **Baylor College of Medicine (BCM)** medical students who have an interest in space medicine can take courses in the world's first officially recognized space medicine track as they pursue their medical degree. The track consists of a set of electives offered at BCM and is managed by the college's **Center for Space Medicine**.

In June 2011, the **NSBRI's headquarters** and the **BCM's Center for Space Medicine (CSM)** relocated to **Rice University's BioScience Research Collaborative (BRC)**, across the street from the Texas Medical Center**.** The 16,000-sq. ft. consolidated research facility is located on the ninth floor of the BRC and features multiple reconfigurable laboratories, meeting rooms, classrooms, a 280-seat auditorium, and office space for NSBRI headquarters and BCM personnel, as well as visiting NSBRI researchers from leading institutions from across the country. The new facility is a milestone of collaboration between BCM, Rice, NSBRI, and NASA, and is expected to be an asset to the United States' human space program for years to come. The facility's focus is to train future physicians and scientists and to conduct space-related biomedical research focused on innovations to enhance health care, both in space and on Earth.

Astrogenetix experiment at the International Space Station